THE 2003 PRIBILOF DISTRICT KING CRAB SURVEY

By

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and

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FOREWORD

The Bering Sea Crab Test Fish Project (BSTF), authorized by the State of Alaska under the Test Fish Program (AS 16.05.050 (15)), provided most of the funding for this project. Initiated in 1990, project research initially focused on the population dynamics of and fishing effects on Bristol Bay red king crabs. Triennial surveys of Norton Sound red king crab, Aleutian Islands golden king crab, and St. Matthew Island blue king crab stocks from 1995 through 2000 were also funded under this program. Operational plans for this project are found in Gish and Pengilly (2003a). Operational plans for previous BSTF projects are documented in Gish and Byersdorfer (2002), Gish and Pengilly (2003b), Gish et al. (2002), Tracy and Pengilly (1996 and 1997), Tracy et al. (1999), Watson and Pengilly (1992, 1993a, 1993b, 1994 and 1996), and Watson et al. (1995). Reports and presentations of BSTF projects are itemized in Tracy et al. (1999).

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ABSTRACT

This report describes the 2003 Pribilof District king crab survey documenting the distribution and relative abundance of red king crabs *Paralithodes camtschaticus* and blue king crabs *P. platypus* around the Pribilof Islands during the fall. The primary purpose of this study was to determine the potential for conducting a red king crab fishery without incurring substantial bycatch of blue king crabs. The Alaska Department of Fish and Game (ADF&G) conducted the survey aboard the chartered *F/V Northern Orion*, a 50.3-m (165-ft.) commercial crab-pot-fishing vessel. Results show a substantial overlap in distribution of blue king crabs and legal-sized red king crabs. Results also show that red and blue king crab in the Pribilof District are predominately matured-sized and larger and provide no evidence for recruitment to either stock. Legal-sized red king crabs occurred in only a limited portion of the surveyed area and were generally encountered at only low abundance within that area of occurrence.

INTRODUCTION

The Pribilof District includes the Bering Sea waters between 168°00' W longitude and the United States-Russia Maritime Boundary Line of 1990, bounded to the north by the latitude of Cape Newenham (58°39' N latitude), bounded to the south by 54°36' N latitude between 168°00' W longitude and 171°00' W longitude, and bounded to the south by 55°30' N latitude between 171°00' W longitude and 173°30' E longitude. The commercial fisheries for red king crab *Paralithodes camtschaticus* and blue king crab *P. platypus* in the Pribilof District are managed by the Alaska Department of Fish and Game (ADF&G) under the State/Federal cooperative management regime established by the federal Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crab (FMP) as adopted by the North Pacific Fisheries Management Council (NPFMC 1998). The FMP defines a minimum stock size threshold (MSST) and maximum sustainable yield (MSY) biomass for stocks managed under the plan. The MSST sets the stock abundance threshold below which stocks are considered "overfished"; MSY biomass is the target for rebuilding of overfished stocks. The annual National Marine Fisheries Service (NMFS) summer eastern Bering Sea trawl survey (Rugolo et al. 2003) provides the data used for estimating the levels of Bering Sea red and blue king crab stocks relative to MSST and MSY biomass and for the determination of the fishery guideline harvest levels (GHLs) established by the state.

The Pribilof District red king crab commercial fishery was first opened in 1993 and was reopened for each subsequent fishery season through 1998, producing a total harvest of 6.3-million pounds worth $28.6 million (Bowers et al. 2003). The fishery was closed in 1999 and has remained closed through the present. Fishery performance was poor during the final years of the Pribilof red king crab fishery (Bowers et al. 2003) and no recruitment to the red king crab stock was apparent in the trawl surveys of recent years (Rugolo et al. 2003). However, Pribilof District red king crab stock abundance estimates continued to be well above MSST and near to or above MSY biomass through the closure period (NPFMC 2003) and estimated numbers of mature-sized and legal-sized males during 1999-2003 were comparable to those during 1993-1998 (Vining and Zheng 2004). Hence the fishery closure was not a response to low abundance estimates for mature-sized and legal-sized crabs. Instead, the Pribilof red king crab fishery has been closed to address conservation concerns resulting from two sources of uncertainty.

The first source of uncertainty concerns the potential for bycatch of Pribilof blue king crab during prosecution of the red king crab fishery. The Pribilof blue king crab fishery had been opened coincident with the Pribilof red king crab fishery during the fall 1995-1998 seasons (Bowers et al. 2003). The blue king crab fishery has been closed since 1999, however, when NMFS trawl survey results indicated the stock was below the state threshold for a fishery opening and was approaching MSST. Survey results since 1999 showed continued declines in the stock through 2002, when it was estimated to be below MSST and declared "overfished" (NPFMC 2002); the stock remained in overfished condition in 2003 (NPFMC 2003). No sign of recruitment to the blue king crab stock has been apparent in the trawl surveys of recent years (Rugolo et al. 2003). Closure of the Pribilof red king crab fishery since 1999 has been due in large part to concerns over the potential for bycatch of blue king crab during that stock's period of decline (Bowers et al. 2003).

The blue king crab bycatch concerns are difficult to substantiate, however. There is scant fishery observer data from historic Pribilof District king crab fisheries and no information available on the distribution of either red or blue king crab during the fall fishery except for catch and effort by ADF&G statistical area reported during dockside interviews and on fish tickets. Catch statistics by statistical area only provide information on legal-sized males and statistical areas are too large (approximately 900 nmi^2) to provide needed information on distribution. Nonetheless, a large proportion of the annual harvest of both red and blue king crabs occurred in a single area (statistical area 697500) directly east of St. Paul Island (Morrison and Gish 1994, 1996, 1997a and 1997b; Morrison et al. 1998 and 1999; Figure 1), suggesting significant potential for blue king crab bycatch in a directed red king crab fishery.

The second source of uncertainty is the reliability of population estimates for Pribilof red king crab afforded by the NMFS eastern Bering Sea trawl survey. Population estimates for this stock have low precision due to the low number of survey tows in which red king crabs are captured in the Pribilof District (NPFMC 2003, Rugolo et al. 2003, Vining and Zheng 2004). Additionally, the distribution of legal-sized red king crabs captured by the trawl survey has often shown little concordance with the distribution of catch during the commercial fishery. For example, in 1994 and 1997 the highest densities of legal-sized red king crabs encountered during the trawl survey occurred to the west of St. Paul Island (Stevens et al. 1994, Stevens et al. 1998), whereas highest catches during the subsequent commercial fisheries occurred in the statistical area to the east of St. Paul Island (Morrison and Gish 1996, Morrison et al. 1998). Whether that lack of concordance reflects the poor precision afforded by the trawl survey or seasonal movements between the time of the survey (late June to early July) and the fishery season (September) is unknown. The low precision of the Pribilof red king crab stock estimates raises concerns for management of both the red king crab stock and protection of the blue king crab stock. Establishment of GHLs on the basis of low precision estimates could result in overfishing of the red king crab stock and in a prolonged fishery that would increase the exposure of the blue king crab stock to the effects of bycatch during the fishery.

In September 2003 ADF&G performed the first of two planned pot surveys for king crab in the Pribilof District during the fall to obtain information needed on the distribution and relative abundance of legal-sized red king crab relative to blue crab during the normal fishing season. The survey concentrated on the areas of highest catch and effort during the 1993-1998 commercial fisheries and included the areas of known highest abundance of red and blue king crab in the Pribilof District in 2003. The survey was designed to provide denser spatial sampling than the standard NMFS trawl survey within that area. The primary objective of the survey was to determine the potential for prosecuting a directed fishery for red king crabs in the Pribilof District while minimizing bycatch of blue king crab. A secondary objective was to assess the reliability of abundance estimates that are used to establish GHLs for red king crab in the Pribilof District. This report documents the results of the survey pertaining to the distribution and relative abundance of red and blue king crabs around the Pribilof Islands during September 2003. Although particular attention is given to results that are most relevant to the survey objectives, we also report on the catch of other commercial crab species encountered during the survey.

METHODS

Survey Area and Design

Prior to the survey, a survey station pattern was developed for an area encompassing the Pribilof Islands waters and primarily bounded by 56° 30' N latitude to the south, 57° 30' N latitude to the north, 169° W longitude to the east, and 171° 00' W longitude to the west. The survey station pattern within those boundaries was designed by first designating stations at the centers and corners of the stations in the 20 x 20-nm survey grid established for the NMFS eastern Bering Sea trawl survey (Stevens et al. 2002). Additional stations were added to achieve 5-nmi spacing between stations for a total of 164 primary stations (Figure 2). The minimum goal for the survey was to fish 142 of the primary stations, with the 22 stations in the southwest having lowest priority due to the expectation that they were outside the distribution of king crab. Secondary stations to the north (from 57° 30' to 57° 40' N latitude and 169° to 170° 30' W longitude) and east (from 57° 15' to 57° 40' and 168° 40' to 169° W longitude) were also established prior to the survey and added to the survey pattern. The secondary stations were to be fished dependent upon time available and results for king crab reported from the summer 2003 NMFS eastern Bering Sea trawl survey.

One-hundred-seventy-four-stations were actually fished during the survey (Figure 2, Appendix A), resulting in a survey area that covered approximately 4,250 nmi^2. The area surveyed included the ADF&G shellfish statistical areas that accounted for 83% to 99% of the total annual Pribilof Islands red king crab harvests for the 1993 through 1998 seasons (Morrison and Gish 1994, 1996, 1997a and 1997b; Morrison et al. 1998 and 1999). In particular, the survey area includes statistical area 695700 (bounded by 57° 00' N latitude, 57°30' N latitude, 169° 00' W longitude, and 170° 00' W longitude). Statistical area 695700 (Figure 1) accounted for the largest portion of the total Pribilof red king crab harvest during 1993-1998 (36%) and of the total Pribilof Islands blue king crab harvest during 1995-1998 (42%). Additionally, the surveyed area covered most of the distribution, as indicated by the summer 2003 NMFS eastern Bering Sea trawl survey (Rugolo et al. 2003), of blue king crabs and legal red king crabs in the Pribilof District in 2003. Each of the five tow locations within the Pribilof District at which legal red king crab were captured during the 2003 trawl survey were within the boundaries of the pot survey area. Of the 10 tow locations within the Pribilof District at which blue king crab were captured during the trawl survey, only two were not within the boundaries of the pot survey area. Those two tow locations were to the east and north of the pot survey area and captured only one blue king crab each. Hence the survey area included the area of highest historical fishery production for the red king crab fishery and the area with highest expectation for capturing legal red king crab and blue king crab in the fall of 2003.

The survey was conducted aboard the chartered vessel *F/V Northern Orion*, a 50.3-m (165-ft.) commercial fishing vessel. Four commercial crab pots, arrayed in a north-south orientation and with a spacing of 0.125 nmi between adjacent pots, were fished at the center of each station. Each pot measured 7' x 7' x 34", was fitted with 2.75" stretch mesh on all webbing, and had two opposing tunnel openings measuring 8' x 36". Each pot was baited with two 2-quart containers of chopped Pacific herring *Clupea pallasii*. During the first week of the survey, one Pacific cod *Gadus macrocephalus* was used as hanging bait in two randomly chosen pots per station; however, after the first week of the survey, one Pacific cod was used as hanging bait in every

survey pot. Soak times for all 696 pots fished during the survey ranged from 22.5 to 85.7 hours and averaged 36.5 hours; soak time for pots not affected by unplanned delays (576 pots or 83% of the total) ranged from 22.5 to 42.0 hours and averaged 26.5 hours. The charter vessel captain recorded location, depth, set date and time, and pull date and time for each pot fished during the survey. The first pot fished for the survey was set on September 2, 2003; the last survey pot was pulled on September 26, 2003.

Catch Sampling

Species composition was determined for each pot fished during the survey, and all commercially important crab species were scrutinized. The fork or total length was recorded for all commercially important fish species and all other fish and invertebrate species were enumerated.

Red and blue king crabs, hair crabs *Erimacrus isenbeckii,* Tanner crabs *Chionoecetes bairdi* and snow crabs *C. opilio* were fully enumerated to provide catch data by sex and size. Each red and blue king crab and hair crab obtained from survey pots was sexed and measured for carapace length. Carapace length (CL) was measured to the nearest millimeter from the posterior margin of the right eye socket to the midpoint of the rear margin of the carapace (Wallace 1949). Tanner crab and snow crab were sexed and measured for carapace width. Carapace width (CW) was measured to the nearest millimeter as the greatest straight-line distance (including spines for legal status determination, excluding spines for biological measurements) across the carapace at a right angle to a line midway between the eyes to the midpoint of the posterior margin of the carapace (Jadamec et al. 1999). Subsampling of Tanner and snow crabs occurred when catches or conditions precluded sampling every crab. If subsampling occurred, at least 20 crabs per pot were examined. The fishery-legal status of male crabs was determined by the CW including spines relative to minimum legal size (≥ 6.5" for red and blue king crab, ≥ 3.25" for hair crab, ≥ 5.5" for Tanner crab, and ≥ 3.1" for snow crab).

The carapace condition (shell age) of each crab was recorded as new pliable shell, new shell, old shell or very old shell. Shell age was determined by examining the ventral side of the coxa (shoulders) of the walking legs (pereiopods) for discoloration and deterioration from scratching and other abrasive action attributable to prolonged contact of the crab's shell with the substrate. Full shell age descriptions are given in Gish and Pengilly (2003a), Blau and Watson (1998), and Jadamec et al. (1999).

The reproductive status of each female crab was determined; if eggs were present the percent clutch fullness, embryo development, color of eggs, and percent dead eggs were recorded (Gish and Pengilly 2003a). Loss of limbs and the presence of disease or parasites were also recorded.

Ancillary Data Collection

In addition to catch sampling, other ancillary data and specimen collection was conducted during the survey. Results of those activities will be provided in forthcoming reports.

Benthic Habitat Mapping, Sediment Sampling and Video Observations

Data on benthic habitat type, or seabed classification, were obtained during this charter using QTC View[1] methodology (Quester Tangent Corporation 1998) which consisted of acquiring data from the ship's echo sounder (the first return ping or waveform). This waveform varies according to the characteristic texture of the surficial seafloor sediment (the frequency distribution of grain sizes) or the immediate subsurface. These waveforms are then classified into groups that correspond to different bottom types. The location of these bottom types are correlated with a dedicated differential global positioning system/wide area augmentation system (DGPS/WAAS) navigation system and, with the use of QTC View software, produce a color diagram of differing bottom types, or benthic habitat.

A minimum of one benthic sediment sample from each bottom type was obtained to help ground-truth the echo sounder data return. Samples were obtained, primarily at slack tide, using a Van Veen grab. The sediment samples will be classified according to the percentage of mud, sand, and gravel contained in each sample (Folk 1954). The distribution and relative abundance of red and blue king crabs in the study area will be assessed as to their correlation with different habitat types.

Underwater video images, obtained with a drop camera and a mini digital video (DV) camcorder, were taken of each bottom habitat type to visually document the sediment or substrate type. Every effort was made to obtain this video from each site sampled by the Van Veen grab.

Environmental Data Collection

Three conductivity/temperature/depth (CTD) and two submersible temperature recorder (STR) data loggers were deployed to obtain environmental conditions concurrent with CPUE data. The data loggers were deployed in a manner that provided coverage over the range of area and depths fished during the charter; no more than one data logger was deployed at any single station. Data obtained were analyzed for evidence of any association between CPUE and the corresponding environmental parameters.

Food Habits Sampling

Stomachs from red and blue king crabs were collected for future laboratory analysis. These samples were obtained during normal catch sampling in a manner that covered the range of benthic habitat types encountered. Methods for analysis of stomach contents will follow those of Jewett and Feder (1982). Contents of each stomach sample will be sorted by taxon in the laboratory and percent wet weight of food and percent of occurrence will be computed separately for red and blue king crab. If distinct benthic habitat types can be identified (see above), percent wet weight and percent of occurrence will also be computed for each species by habitat type.

[1] Use of trade name does not constitute an endorsement by ADF&G.

Crab and Fish Collections

Live crabs, as well as several fish and invertebrate species, were collected for the observer practicum held dockside in Dutch Harbor. Fish specimens were obtained for a comparative skeletal collection at the Aleutian Campus of the University of Alaska Fairbanks to be used in local archeological projects, studies of historic area climatic changes, and Unalaska schools.

Cost-Recovery Fishing

Cost-recovery fishing directed on legal red king crabs was also conducted within the survey area in conjunction with the survey vessel charter during 21-26 September 2003. Cost-recovery fishing was conducted in two small areas, one centered at 57°32' N latitude, 169°28' W longitude and the other centered at 56°59' N latitude, 169°24' W longitude, after performance of the survey in those areas. Results of the cost-recovery fishing and catch sampling during that fishing are reported in Byersdorfer (2004).

RESULTS

Catch Composition

A total of 10,441 crabs of commercially important species were captured during the survey (Table 1). The most abundant species was Tanner crab at 48.1% of the catch, followed by snow crab (43.3%), red king crab (5.2%), blue king crab (1.9%), *C. bairdi* x *C. opilio* hybrid crab (1.3%), and hair crab (0.2%). A total of 2,064 fish of 17 different species and 15,144 invertebrates representing 59 species were also caught during the survey (Table 2).

Red King Crab

Red king crabs were captured at 59 of the 174 stations fished during the survey (Figure 3). Those stations were largely in the northeast portion of the surveyed area, north of St. George Island and east of St. Paul Island; only one of the 59 stations at which red king crab were captured was west of the longitude of St. Paul Island. Females showed a more limited distribution (captured at 22 stations) than males (captured at 49 stations) and were predominately captured at stations around St. Paul Island, shoreward of the stations at which males occurred. Legal males were captured at 47 stations.

A total of 548 red king crabs were captured and they were almost exclusively larger, mature-sized animals. Seventy-three percent (402) of the captured red king crabs were males. Males ranged in size from 107-mm CL to 200-mm CL (Figure 4) and nearly 100% (401) of the males were ≥ 120-mm CL, the size used to identify mature males for management purposes (Vining and Zheng 2004). Ninety-six percent (386) of all captured males were of fishery legal size, but only 14% (54) of those legal males would be considered new recruits to legal size (i.e., were new-shelled legal males <150-mm CL; Vining and Zheng 2004). Of the 16 sublegal males captured, 15 were pre-recruits estimated to be one molt from legal size (i.e., sublegal males ≥ 120-

mm CL; Vining and Zheng 2004). Ninety-one percent of all captured males were in new-shell condition and new-shelled crabs dominated all male size classes (Figure 4).

The 146 captured female red king crabs ranged in size from 96-mm CL to 183-mm CL (Figure 5) and averaged 140-mm CL. Only two females were smaller than 102-mm CL, the estimated size at which 50% of Pribilof female red king crab are mature (Otto et al. 1990). One-hundred-forty-four (99%) of the captured females were mature, as evidenced by presence of eggs or empty egg cases. Of the mature females, 94% carried eggs.

Legal males were captured at 29% (22) of the 77 stations centered within the three statistical areas that produced the majority of the commercial red king crab catch during the 1993-1998 commercial seasons (i.e., statistical areas 695631, 695632 and 695700; Figure 1). No legal males were captured at any of the 55 stations with centers within statistical areas 705630, 705701, and 705702, which were also important areas for commercial fishery during 1993-1998. Legal males were captured at 60% (25) of the remaining 42 stations, all of them within statistical areas north and east of the statistical areas that were important for fishery production during 1993-1998.

Catch of legal-sized male red king crabs was highly localized. No legal-sized males were captured at 127 of the 174 stations, only 7 stations accounted for 74% (286) of all captured legal males, and one station (station 80 on the border of statistical areas 695631 and 695700) alone accounted for 41% (157) of all legal males captured. As a result, catch per unit effort (CPUE) of legal male red king crabs was very low over the entire survey area at 0.6 crabs per pot lift. Even when considering only the 77 stations within statistical areas 695631, 695632, and 695700, the legal male CPUE was only 1.0 crab per pot. However, in the 47 stations where legal males were captured, the CPUE for legal males was somewhat higher at 2.1 crabs per pot lift and in the top seven stations for legal males the legal CPUE was 10.2 crab per pot lift. The highly localized distribution of legal males is also revealed when examining the CPUE in the 8 stations adjacent to the station that produced the highest catch of legal males (i.e., station 80 with a CPUE of 39.3); in those 8 stations the legal CPUE was only 0.9 crabs per pot lift.

Blue King Crab

Blue king crabs were captured at 50 of the 174 stations fished during the survey (Figure 6). Males occurred at 38 of those locations and were north and east of St. Paul Island and northeast of St. George Island. Females tended to be captured in the eastern portion of the species' distribution in the survey area, occurring at 31 locations that were northeast of both islands.

A total of 202 blue king crabs were caught during the survey, all of which were large, mature-sized animals. Thirty-four percent (69) of the captured blue king crabs were males and they ranged in size from 120-mm CL (the size used to identify mature males for management purposes; Vining and Zheng 2004) to 176-mm CL (Figure 7). Seventy-seven percent (53) of the males were legal sized and only 8% (4) of the legal males would be considered newly recruited to legal size (i.e., were new-shelled legal males <149-mm CL; Vining and Zheng 2004). Males in new-shell condition were present over the size range of the captured males, but accounted for only 38% (26) of all males.

The 133 captured female crabs ranged in size from 92-mm CL to 156-mm CL (Figure 8). Only one female was <96-mm CL, the estimated size at 50% maturity for female Pribilof blue king crab (Somerton and MacIntosh 1983), and 81% (108) were between 115-mm CL and 139-mm CL. All of the females were mature as evidenced by the presence of eggs or empty egg cases. Consistent with biennial spawning in blue king crab (Somerton and MacIntosh 1985), only 55% (73) of the females carried eggs.

Given the restricted distribution of blue king crab within the surveyed area, the CPUE of legal-sized male blue king crabs over the entire surveyed area was only 0.08 crabs per pot. However, there was no group of stations or single station in which the CPUE of legal male blue king crab was high. The CPUE of legal males was 0.4 crabs per pot lift when considering only the 33 stations at which legal males occurred and, at the two stations (stations 152 and 189) with the highest catch of legal blue king crab, the legal male CPUE was only 1.3 crabs per pot lift.

Distribution of Legal Male Red King Crabs Relative to Blue King Crabs

Of the 47 stations that legal male red king crabs occurred at and the 50 stations that blue king crabs occurred at, legal male red king crabs and blue king crabs co-occurred at 34 stations (Figure 9). There was no geographic region easily definable by statistical area or by latitude and longitude at which legal red king crabs occurred without blue king crabs. Highest catches of legal red king crab tended to occur along an arc beginning at station 57 ($56^{o}50'$ N latitude, $169^{o}41'$ W longitude), extending northeast to station 116 ($57^{o}15'$ N latitude, $169^{o}17'$ W longitude), and then extending northwest to station 206 ($57^{o}35'$ N latitude, $169^{o}29'$ W longitude). The stations with highest catches of blue king crab tended to occur east of the arc of highest legal red king crab catches. However, blue king crabs were also captured at stations west of and within that arc of stations.

Legal red king crabs and blue king crabs showed similar depth distributions. Both were captured only at depths from 31 to 50 fathoms, the depth range in which 78% (540) of the total 696 pots lifts were fished during the survey. Of the remaining pot lifts fished during the survey, 65 pots, or 9%, were fished at 11-30 fathoms and 91 pots, or 13%, were fished at 51-61 fathoms. The most commonly fished depths were 37 to 39 fathoms (233 pot lifts, or 33% of total pot lifts) and legal red king crabs and blue king crabs each occurred in 30% (66) of the pots fished in that depth range. Highest CPUE of both legal red king crabs and blue king crabs tended to occur in pots fished at 37 to 39 fathoms. The depth with highest CPUE of legal red king crab depth was 38 fathoms, where 94 pot lifts produced a CPUE of 2.8 crabs per pot lift. Although much of the catch of legal red king crabs at 38 fathoms was produced from a single station (station 80), the legal red king crab CPUE at 38 fathoms without that station considered was, at 1.2 crabs per pot lift, still higher than at any other depth. Blue king crab CPUE at 38 fathoms was 0.8 crabs per pot lift, whereas for the depth range of 37 to 39 fathoms the CPUE was 0.7 crabs per pot lift. Only the 15 pot lifts fished at 45 fathoms showed a higher CPUE for blue king crab at 1.0 crab per pot lift.

Although their distributions overlapped broadly by depth and geographic location, catch per station of legal red king crabs and blue king crabs was negatively associated; highest catches of legal red king crabs occurred at stations with low catches of blue king crabs and highest catches

of blue king crabs occurred at stations with low catches of legal red king crabs (Figure 9). In the 63 stations at which either legal red king crab or blue king crab occurred, the catches for both were generally low. At 50 of those stations, the CPUE for each of legal red king crabs and blue king crabs was ≤ 2.0 crabs per pot lift and averaged 0.5 crabs per pot lift. There were seven stations at which the station CPUE for legal red king crab was > 2.0 crabs per pot lift (ranging from 3.8 to 39.3 crabs per pot lift), and at those the station CPUE for blue king crabs was ≤ 0.5 crabs per pot lift. At the five stations at which CPUE for blue king crabs was > 2.0 crabs per pot lift (ranging from 2.5 to 8.8 crabs per pot lift), the CPUE for legal red king crabs was ≤ 0.8 crabs per pot lift.

Tanner Crab

Tanner crabs were captured at 146 of the 174 stations fished during the survey (Figure 10). Male crabs occurred at 141 of those locations and were distributed throughout most the area surveyed except those adjacent to the islands. The highest numbers of crab were observed primarily between and west of the islands. Female crabs occurred at 123 locations and also were distributed throughout the area. They were predominantly south and west of St. Paul Island and north and west of St. George Island. A total of 5,020 Tanner crabs were caught during the survey, of which 57% were males.

A total of 2,872 male Tanner crabs were captured during the survey. Due to subsampling, only 2,670 males were measured. Carapace width of the measured males ranged from 19-mm to 180-mm and averaged 95.6-mm; 57.2% were between 80-mm and 109-mm CW (Figure 11). Only 42 of the measured males (1.6%) were of fishery legal size (≥ 139.7-mm CW including lateral spines). Crabs >112-mm CW (the size used to identify mature males for management purposes; Zheng and Kruse 1999) comprised 18.7% of measured males. Shell age was recorded for 2,665 male Tanner crabs and 78% of those were in new-shell or new-pliable-shell condition.

There were 2,148 female Tanner crabs captured during the survey. Of those, CW measurements were obtained from 1,629 and reproductive status was determined for 1,626. Measured females ranged in size from 18-mm to 109-mm CW and averaged 79.3-mm CW; 55% of the female crabs were between 75-mm and 89-mm CW (Figure 12). Immature crabs accounted for 25% of the females for which reproductive status was determined. Of the mature females examined, 99% were ovigerous; full clutches were observed in 4.5% of the ovigerous females, dead eggs were observed in less than 1% of the clutches, and no eyed eggs were apparent. Shell age was recorded for 1,627 female Tanner crabs, of which 67% were in new-shell condition.

Snow Crab

Snow crabs were captured at 103 of the 174 stations fished during the survey (Figure 13). Male crabs occurred at all of those locations and were distributed northeast of both islands, southwest of St. Paul Island, and west of St. George Island. Female crabs occurred at 18 locations widely scattered throughout the area inhabited by males. A total of 4,517 snow crabs were caught during the survey and over 99% of those were males.

A total of 4,480 snow crab males were captured on the survey, of which 3,845 were sampled for CW measurements. Carapace width of measured male crabs ranged from 18-mm to 167-mm and averaged 89.2-mm; prominent size modes were observed at 78-mm CW and 104-mm CW (Figure 14). Sixty-seven percent of the measured males were legal-sized (≥ 79-mm CW including lateral spines), but only 28% were of the industry-preferred size (≥ 102-mm CW). New-shell crabs comprised 31% of the sampled males.

There were 37 female snow crabs captured during the survey. Immature crabs accounted for 24% of those captured. Eighty-six percent of the mature females were ovigerous; full clutches were observed in 8.3% of the ovigerous females and no eyed or dead eggs were apparent. New-shell crabs accounted for 68% of all female snow crabs. The female crabs ranged from 46-mm to 110-mm CW, and averaged 70.1-mm CW; the prominent 5-mm CW class mode was 65 to 69-mm CW and it accounted for 35% of the 37 female crabs (Figure 15).

Tanner Crab x Snow Crab Hybrids

Crabs identified as Tanner crab x snow crab hybrids were captured at 51 of the 174 stations fished during the survey (Figure 16). Males occurred at 49 of those locations and were distributed to the northeast of both islands and to the southwest of St. Paul Island and west of St. George Island. Females occurred at 5 locations widely scattered throughout the area inhabited by males and to the west of St. Paul Island. A total of 133 hybrid crabs were caught during the survey, of those crabs 95% were males.

Male hybrid crabs totaled 126, all were shell-aged and measured. Fishery legal status was not determined. The CPUE of male hybrid crab was 0.18 crab per pot. Male new-shell crabs accounted for 73% of the catch, old-shell crabs comprised 23%, and very old-shell crabs were 4% of the catch. Carapace width of male hybrid crabs ranged from 52 to 141-mm CW and averaged 100.6-mm CW. Forty-three percent of the male crabs were ≥ 105-mm CW (Figure 17).

There were 7 female hybrid crabs captured during the survey and all were new-shell crabs. Five crabs were immature, the 2 mature crabs were barren with matted setae. Carapace widths of the female crabs were 63, 64, 65, 68, 70, 78 and 82-mm.

Hair Crab

Hair crabs were captured at 13 of the 174 stations fished during the survey. Male crabs occurred at 6 of those locations and female crabs at 8. They were distributed around St. Paul Island primarily to the north, east and southwest. A total of 21 hair crabs were caught, 43% were males.

Nine male hair crabs were measured and 4 were fishery legal. All males except one were new-shell crabs. Carapace length of male crabs ranged from 45 to 105-mm. No prominent 5-mm length class mode was observed (Figure 18).

There were 12 female hair crabs captured during the survey. Three were immature, the 9 mature crabs did not carry clutches. Nine females were new-shell crabs, 3 were old-shell crabs. The female crabs ranged from 49 to 84-mm CW.

Ancillary Data Collection

Benthic habitat type data were collected throughout the survey area. Sediment samples and video observations from 26 locations and environmental conditions from 47 sites were obtained (Figure 19). Stomachs from 59 crabs (30 red and 29 blue king crabs) were also acquired. Numerous crabs, fish and other invertebrate species were collected for ADF&G observer testing purposes and 13 fish specimens were collected for the University of Alaska.

The purpose of collecting environmental data, sediment and stomach samples and producing a benthic habitat map was to correlate these findings with data on the relative abundance and distribution of red and blue king crabs. These ancillary data are in the process of being analyzed, they will be combined with more data collected on another Pribilof District survey that is scheduled to occur in September 2005 and will be fully addressed in the subsequent survey report.

DISCUSSION

Results of the September 2003 Pribilof District king crab pot survey were similar for red king crab and blue king crab in several respects. Both species showed a distribution limited to eastern and northern portions of the surveyed area. With the exception of 11 female red king crabs captured at one station west of St. Paul Island, all red and blue king crabs were captured at stations east of St. Paul Island and north of St. George Island. Red and blue king crab also showed a similar distribution by depth during the pot survey. Larger, mature-sized animals dominated the catch of both species during the survey; survey results showed no indications for either species of potential recruitment to the mature stock or to the fishery in the near future. Catch per station of both species was generally low at the stations where king crabs were captured, although there was one exceptional station catch of red king crabs. Overall, both species of king crab were far less common than either Tanner crab or snow crab in terms of the number of animals captured or the number of stations at which they were captured.

Because the pot survey had a denser spatial distribution of survey stations than the NMFS trawl survey stations, it afforded greater insights into the characteristics of the distribution of legal male red king crab than is provided by the trawl survey. The pot survey results showed that legal red king crabs in September 2003 had a limited distribution in the Pribilof District within which relative abundance was generally low, but with occasional localized areas of greater abundance. That feature of the distribution of red king crab in the Pribilof District has posed problems for reliable abundance estimation using data from the summer NMFS trawl survey (Rugolo et al. 2003, Vining and Zheng 2004). The highly localized and unpredictable nature of areas of red king crab abundance indicated by this survey was further revealed during cost-recovery fishing conducted in the Pribilof District during and after the survey (Byersdorfer 2004). Two weeks after 157 legal red king crabs (CPUE = 39.3 crabs per pot lift) were captured at station 80 during the survey, the survey vessel returned to station 80 for cost-recovery fishing on legal red king crabs. Although 135 pot lifts were performed for cost-recovery fishing during a 4-day period in a 5-nmi x 7.6-nmi area centered at that survey station, only a total of 80 legal red king crabs were

captured (CPUE = 0.6 crabs per pot lift). The highest catch of legal red king crabs in any of the 135 cost-recovery pot lifts performed in the vicinity of station 80 was only 14 and no legal red king crabs were captured in 45% (61) of the pot lifts. An additional 48 pot lifts for cost-recovery fishing performed near station 206, where the survey CPUE of legal red king crabs was 7.0 crabs per pot lift, captured only 43 legal red king crabs (CPUE = 0.9 crabs per pot lift).

Some commercial fishers with experience fishing for king crabs in the Pribilof District have reported that red king crabs tend not to be captured in the same areas as blue king crabs. Results from this survey provide some support for that observation. Highest catches of legal red king crabs during the survey occurred at stations with low catches of blue king crabs. Similarly, highest catches of blue king crabs during the survey occurred at stations with low catches of legal red king crabs. However, although blue king crabs tended to be captured east of the legal red king crabs during the survey, blue king crabs overlapped broadly in distribution with legal red king crabs. Moreover, the areas that are occupied predominately by blue king crabs or predominately by legal red king crabs appear to be highly localized; stations in which blue king crabs dominated the king catch were interspersed among stations in which legal red king crabs dominated. Hence, although legal red king crabs and blue king crabs may not occupy the same area in abundance at the same time, it would be difficult to define closure areas prior to a commercial season for red king crab in the Pribilof District that would assure minimizing bycatch of blue king crab. In this regard, results from cost-recovery fishing during and after the survey also demonstrated the unpredictable nature of red and blue king crab distribution in the Pribilof District. Of the total 183 pot lifts performed by the survey vessel for cost-recovery fishing in the Pribilof District during September 2003, 44 (24%) were sampled for complete catch composition data (Byersdorfer 2004). Although the sites for that cost-recovery fishing were chosen on basis of survey results indicating areas with highest legal red king crab abundance and low blue king crab abundance, more blue king crabs (29) were captured than legal red king crabs (23) in the sampled pots.

Results on the geographic distribution and size distribution for the Pribilof red and blue king crab from the September 2003 pot survey generally corroborate results reported from the trawl survey performed by NMFS earlier in the summer of 2003 (Rugolo et al. 2003, Vining and Zheng 2004). Neither the NMFS survey nor the ADF&G survey captured mature-sized or legal-sized male red king crabs west or directly south of St. Paul Island. Those areas are where the highest densities of legal red king crabs in the Pribilof District had been captured during previous NMFS summer trawl surveys (Stevens et al. 1993, 1994, 1996, 1998, 2000, 2002; Rugolo et al. 2001). Neither survey provided evidence of juvenile crabs that could provide recruitment to the mature or fishable component of either stock. Data collected by the trawl survey in 2003 were used to estimate abundance of blue and red king crab in the Pribilof District (Vining and Zheng 2004). Although we could not compute population estimates from the data collected from the pot survey, the results of the pot survey for blue king crab were consistent with the estimates from the trawl survey. Both surveys indicated that the blue king crab stock is depressed with no indication of stock conditions improving in the near future. On the other hand, the summer 2003 trawl survey also provided data that resulted in an estimate for legal red king crab abundance in the Pribilof District of 1.4 million crabs (Vining and Zheng 2004). However, given the results of the September 2003 pot survey, as well as the associated efforts at cost-recovery fishing in the Pribilof District (Byersdorfer 2004), we find it doubtful that even a small commercial red king

crab fishery (e.g., 0.5 million pounds or roughly 70,000 animals) could have been prosecuted in the fall of 2003 without a prolonged season that would increase the bycatch of blue king crab.

Changes in biological productivity have been linked to changes in the Bering Sea environment (Schumacher et al. 2003; Livingston and Wilderbuer 2004). The apparent lack of king crab recruitment in the Pribilof Islands area may reflect a large-scale environmental event affecting abundance and distribution. Average bottom temperatures obtained by NMFS on their 2003 trawl survey in late June and early July were the highest observed in recent years within the study area (Robert Otto, NMFS Kodiak, personal communication). The distribution of red king crab caught on the NMFS trawl survey was anomalous compared to previous years. Red king crabs in prior years were typically distributed south and southwest of St. Paul Island; this year the primary concentration was found north and northeast of the island (Rugolo et al. 2003). The extent to which this redistribution of red king crabs affected the results of the ADF&G September 2003 pot survey is not known. The Pribilof District will be the site of another ADF&G king crab pot survey in September 2005 to gain additional information on the distribution and condition of red and blue king crab stocks.

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Table 1. The 2003 Pribilof District pot survey catches of crabs and fish of commercial importance and all other fish, ranked by number of occurrences.

Scientific Name	Common Name	Total
	Commercial Crab	
Chionoecetes bairdi	Tanner Crab	5,020
Chionoecetes opilio	Snow Crab	4,517
Paralithodes camtschaticus	Red King crab	548
Paralithodes platypus	Blue King Crab	202
Chionoecetes hybrid	Hybrid Tanner Crab	133
Erimacrus isenbeckii	Hair Crab	21
		10,441
	Commercial Fish	
Gadus macrocephalus	Pacific Cod	784
Limanda aspera	Yellowfin Sole	540
Hippoglossus stenolepis	Pacific Halibut	63
Theragra chalcogramma	Walleye Pollock	44
Lepidopsetta polyxystra	Northern Rock Sole	2
Sebastes polyspinis	Northern Rockfish	2
		1,435
	Other Fish	
Hemilepidotus jordani	Yellow Irish Lord	501
Myoxocephalus sp.	Great or Plain Sculpins	87
Podothecus acipenserinus	Sturgeon Poacher	18
Bathymaster signatus	Searcher	13
Hemitripterus bolini	Bigmouth Sculpin	3
Anarhichas orientalis	Bering Wolffish	2
Psychrolutes phrictus	Blob Sculpin	1
Sebastes sp.	Rockfish Unidentified	1
Rajidae	Skate Unidentified	1
Cottidae	Sculpin Unidentified	1
Zoarcidae	Eelpout Unidentified	1
		629

Table 2. The 2003 Pribilof District pot survey catches of other invertebrate species, ranked by number of occurrences.

Scientific Name	Common Name	**Total**
Asterias amurensis	Purple-Orange Sea Star	8,118
Hyas lyratus	Pacific Lyre Crab	1,498
Pagurus aleuticus	Aleutian Hermit Crab	1,064
Neptunea pribiloffensis	Pribilof Whelk	1,042
Ophiura sarsi	Notched Brittlestar	658
Buccinum scalariforme	Ladder Whelk	478
Pagurus ochotensis	Alaskan Hermit Crab	284
Ophiurida	Brittlestar Unidentified	280
Fusitriton oregonensis	Hairy Triton	238
Scyphozoa	Jellyfish Unidentified	218
Strongylocentrotus droebachiensis	Green Sea Urchin	216
Elassochirus tenuimanus	Widehand Hermit Crab	213
Pagurus trigonocheirus	Fuzzy Hermit Crab	207
Oregonia gracilis	Graceful Decorator Crab	169
Pagurus confragosus	Knobbyhand Hermit Crab	94
Octopus dofleini	Giant Octopus	70
Elassochirus cavimanus	Purple Hermit Crab	48
Neptunea lyrata	Lyre Whelk	37
Cucumaria fallax	Sea Football	25
Lethasterias nanimensis	Blackspined Sea Star	24
Buccinum polare	Polar Whelk	20
Colus sp.	Colus Whelk Unidentified	14
Plicifusus (=Colus) kroyeri	Kroeyer's Plicifus	14
Actiniaria	Sea Anemone Unidentified	11
Elassochirus gilli	Pacific Red Hermit Crab	11
Paguridae	Hermit Crab Unidentified	8
Boltenia ovifera	Sea Onion	8
Mytilidae	Mussel Unidentified	6
Modiolus modiolus	Northern Horse Mussel	6
Chlamys rubida	Reddish Scallop	6
Ophiopholis aculeata	Ubiquitous Brittle Star	5
Styela rustica	Sea Potato	5
Thouarella sp.	Primnoidae Coral	4
Hyas coarctatus	Arctic Lyre Crab	4
Colus halli	Shrew Whelk	4
Octopus sp.	Octopus Unidentified	4

-Continued-

Table 2. (page 2 of 2)

Scientific Name	Common Name	Total
Gorgonocephalus eucnemis	Basketstar	4
Gersemia sp.	Sea Raspberry	3
Ophiopholis longispina	Brittle Star	3
Neptunea ventricosa	Fat Whelk	2
Buccinum	Buccinum Whelk Unidentified	2
Evasterias echinosoma	Giant Sea Star	2
Porifera	Sponge Unidentified	2
Hydroidea	Hydroid Unidentified	1
Gorgonacea	Gorgonian Coral Unidentified	1
Nereis	Clam Worm	1
Eunoe nodosa	Giant Scale Worm	1
Telmessus cheiragonus	Helmet Crab	1
Pagurus dalli	Whiteknee Hermit Crab	1
Gastropoda	Snail Unidentified	1
Bivalvia	Bivalve Unidentified	1
Bivalvia	Cockle Unidentified	1
Serripes groenlandicus	Greenland Cockle	1
Crossaster papposus	Rose Sea Star	1
Pteraster obscurus	Obscure Sea Star	1
Echinacea	Sea Urchin Unidentified	1
Flustra serrulata	Leafy Bryozoan	1
Halocynthia aurantium	Sea Peach	1
		15,144

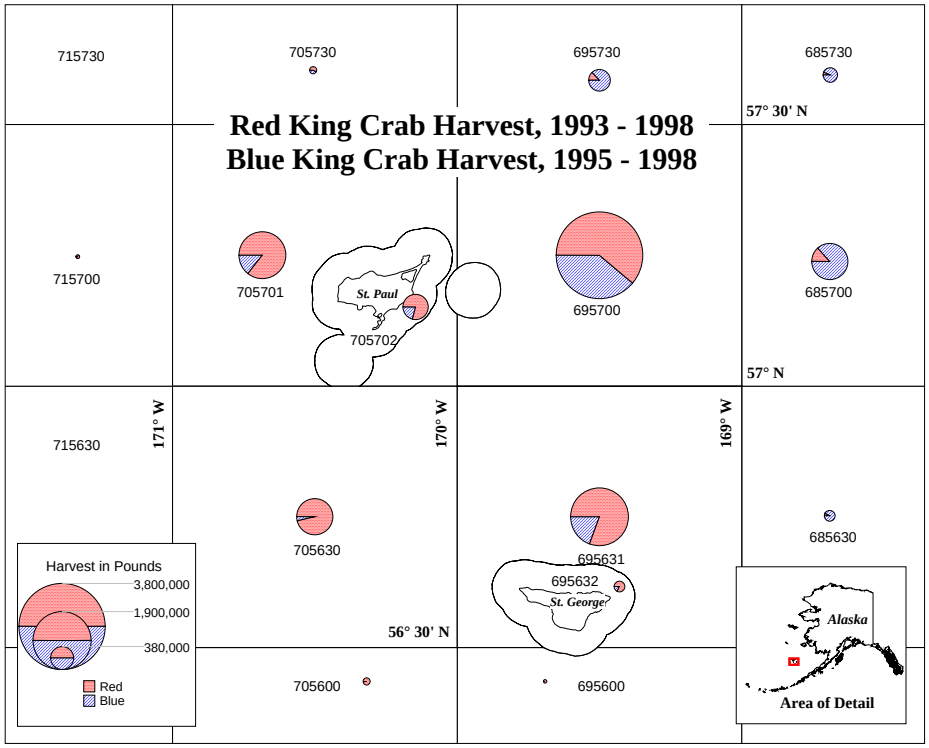

Figure 1. King crab harvest in the Pribilof District by statistical area for the years 1993 through 1998.

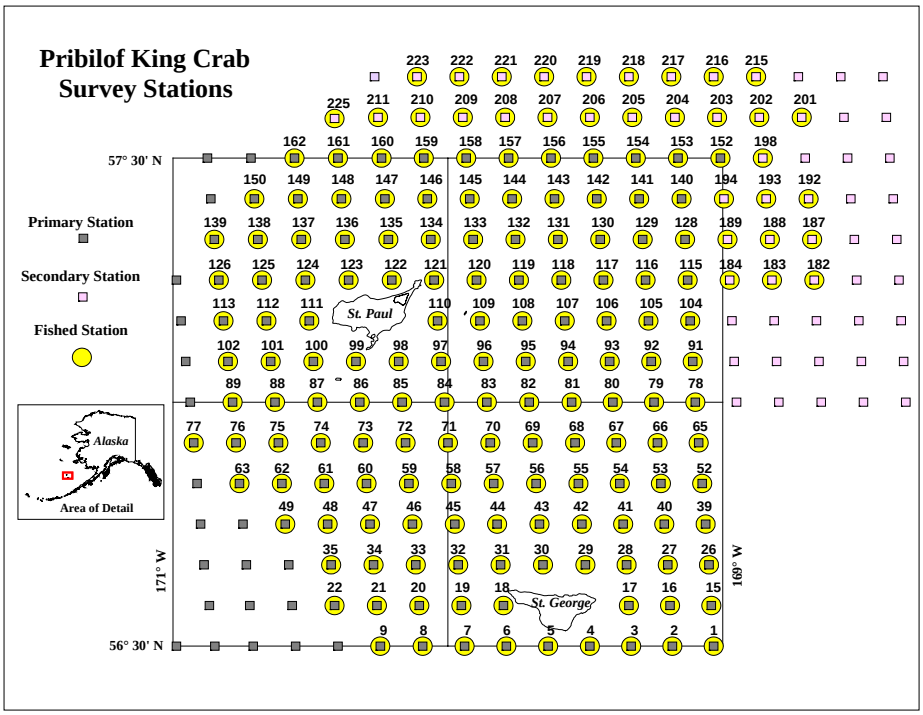

Figure 2. The 2003 Pribilof District king crab survey area showing the location of primary, secondary and fished stations.

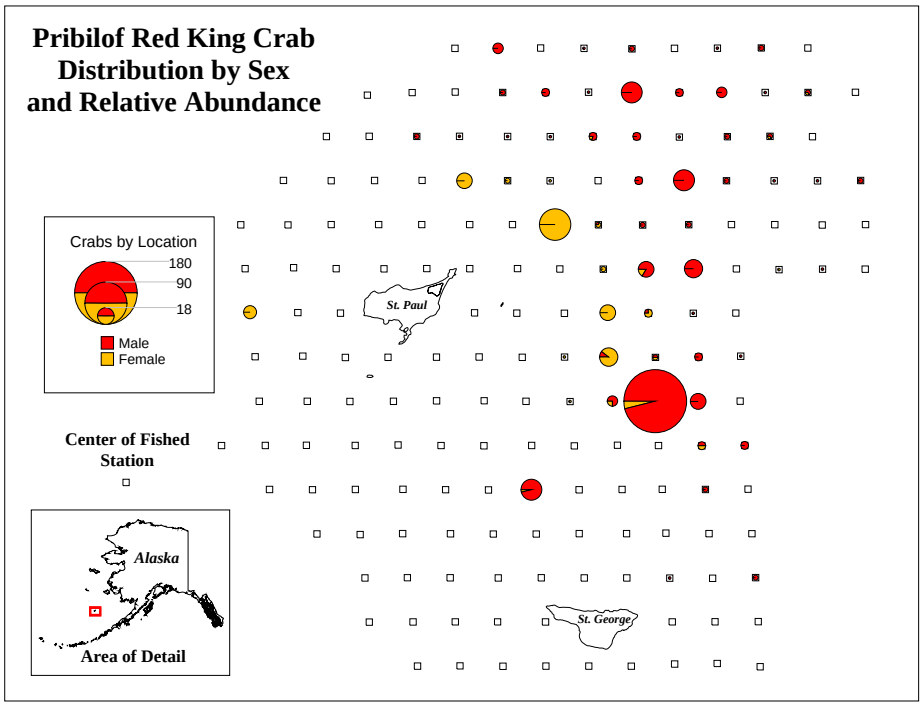

Figure 3. Distribution and relative abundance by sex of red king crab captured in the Pribilof District during the 2003 survey.

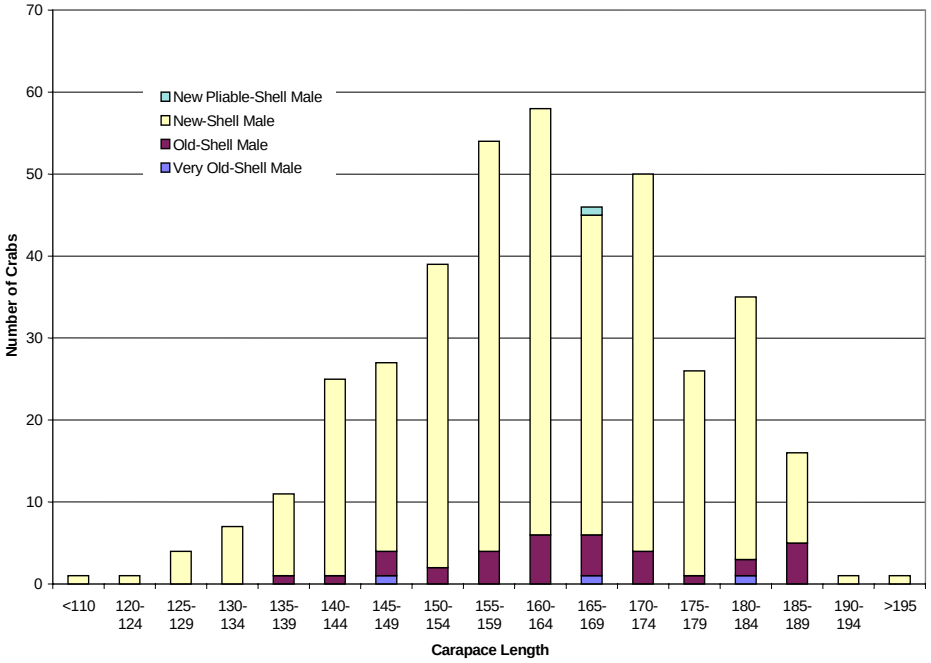

Figure 4. Male red king crab length frequency, by 5-mm size classes, showing shell-age categories.

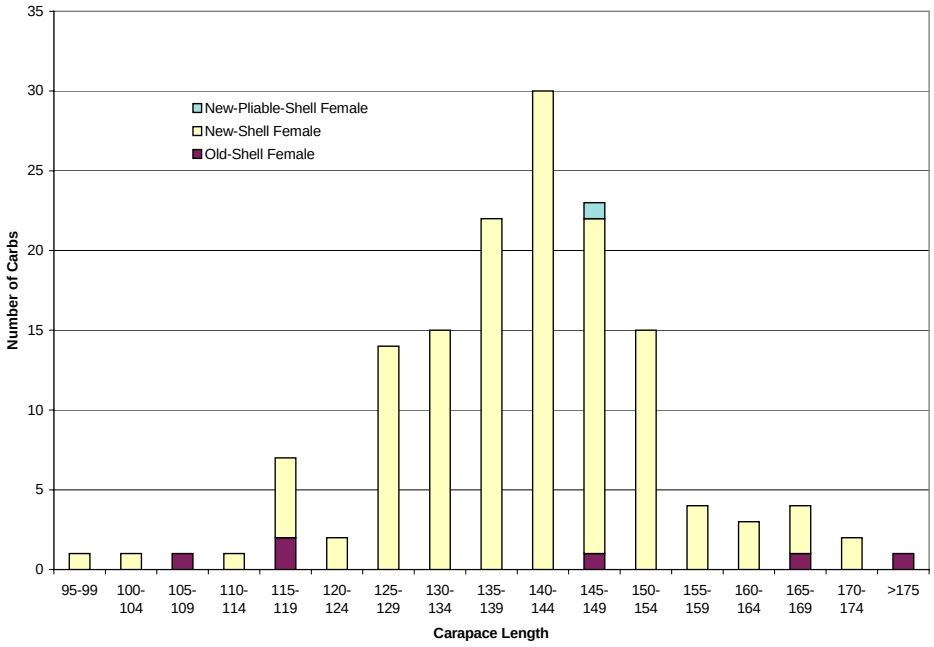

Figure 5. Female red king crab length frequency, by 5-mm size classes, showing shell-age categories.

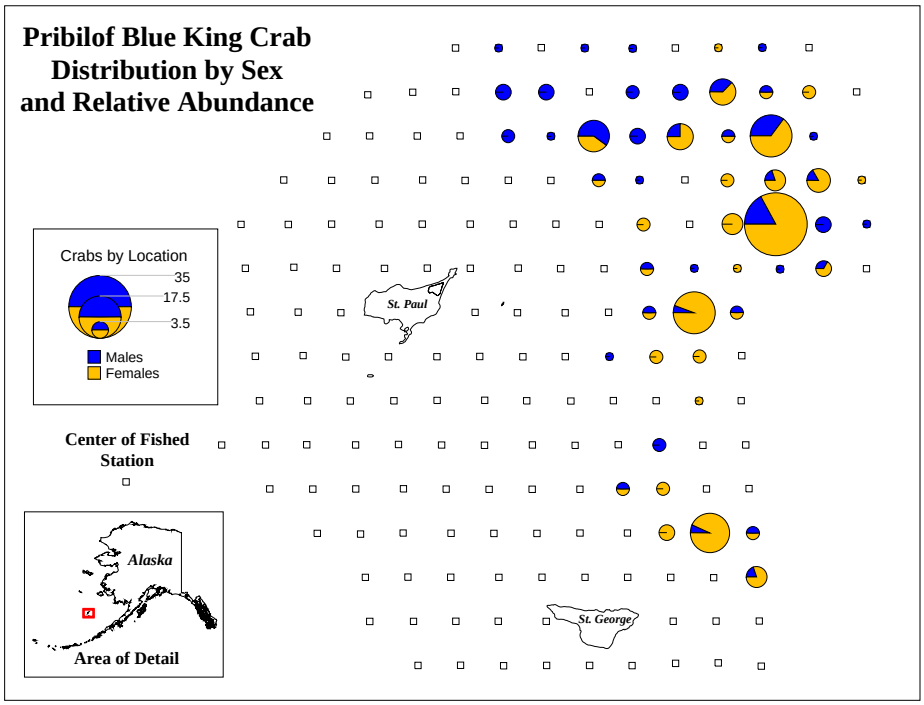

Figure 6. Distribution and relative abundance by sex of blue king crab captured in the Pribilof District during the 2003 survey.

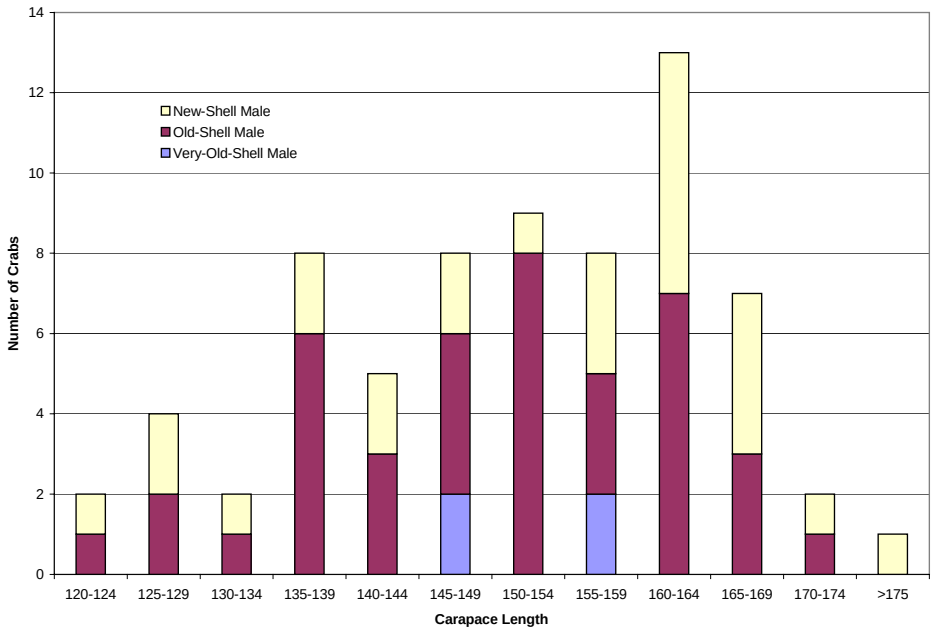

Figure 7. Male blue king crab length frequency, by 5-mm size classes, showing shell-age categories.

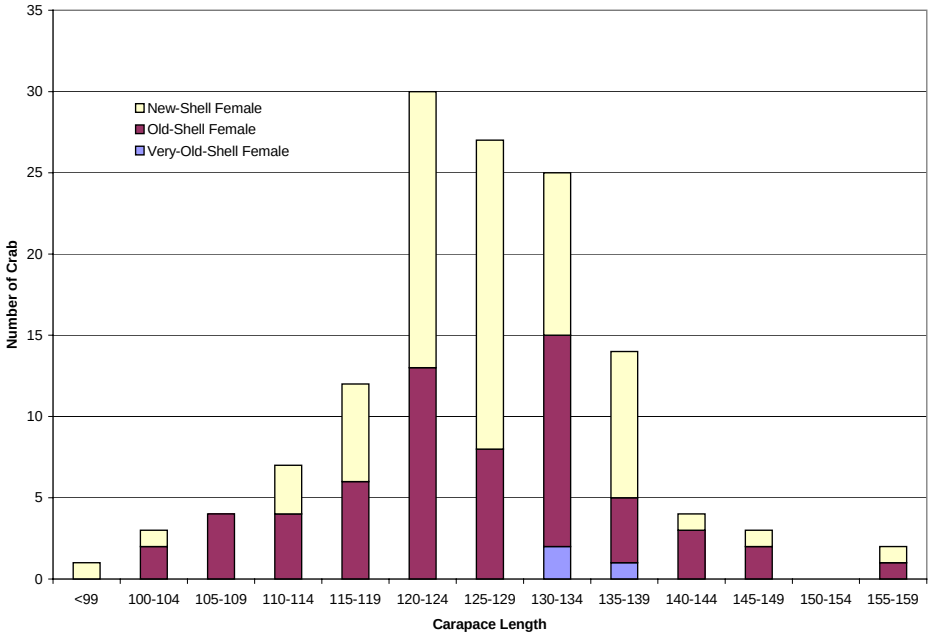

Figure 8. Female blue king crab length frequency, by 5-mm size classes, showing shell-age categories.

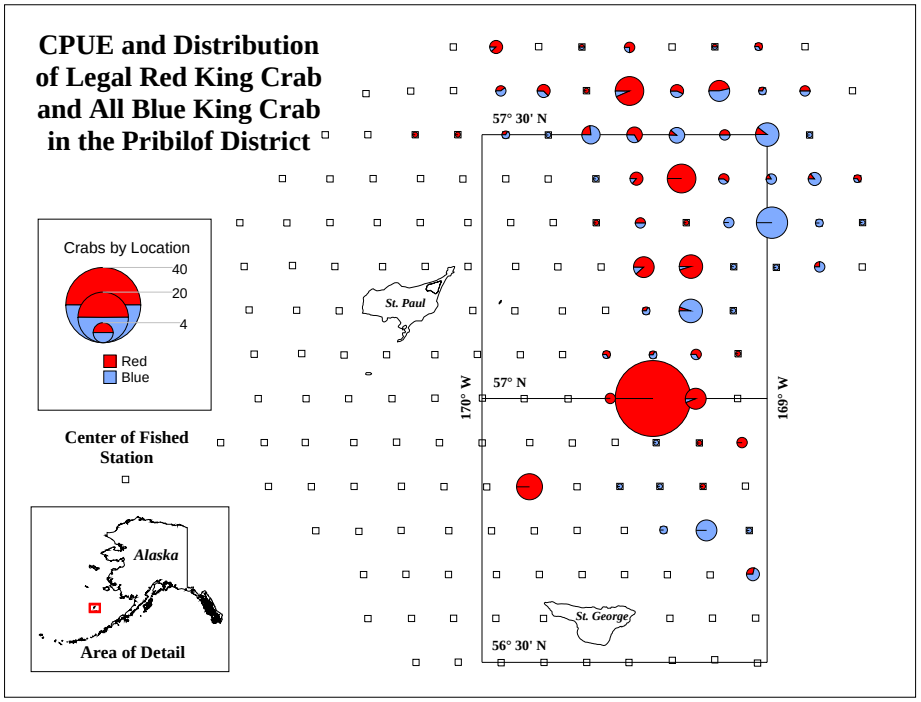

Figure 9. CPUE and distribution of legal red king crab and all blue king crab captured in the Pribilof District during the 2003 survey.

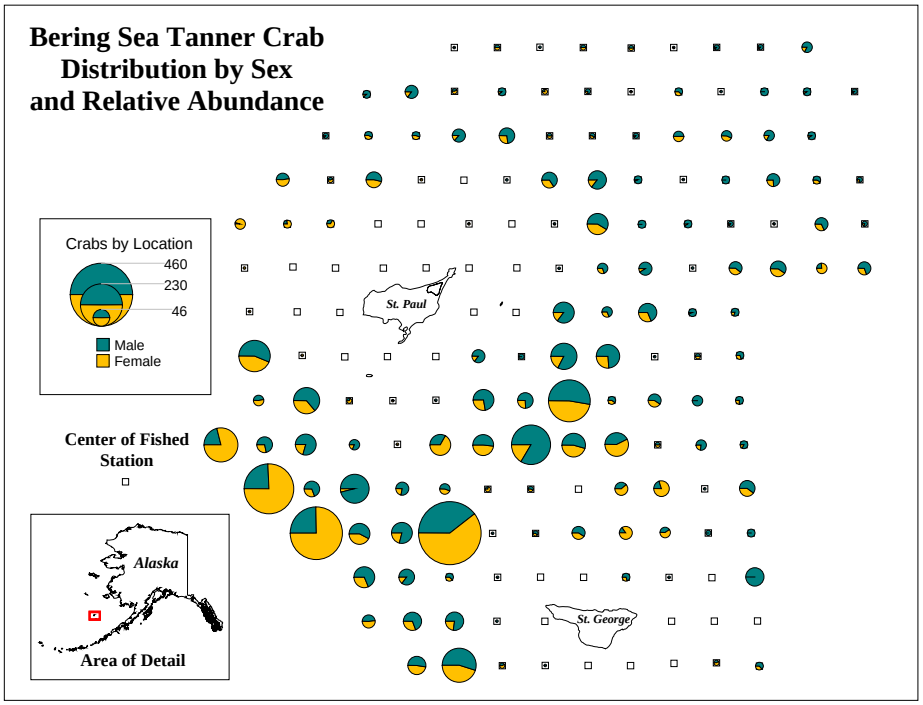

Figure 10. Distribution and relative abundance by sex of Tanner crab captured in the Pribilof District during the 2003 survey.

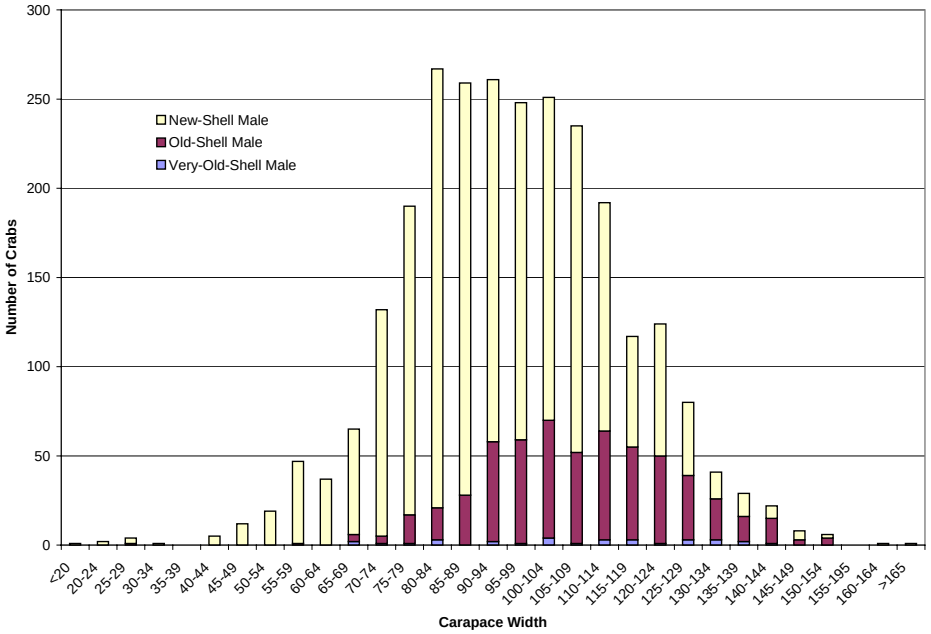

Figure 11. Male Tanner crab width frequency, by 5-mm size classes, showing shell-age categories.

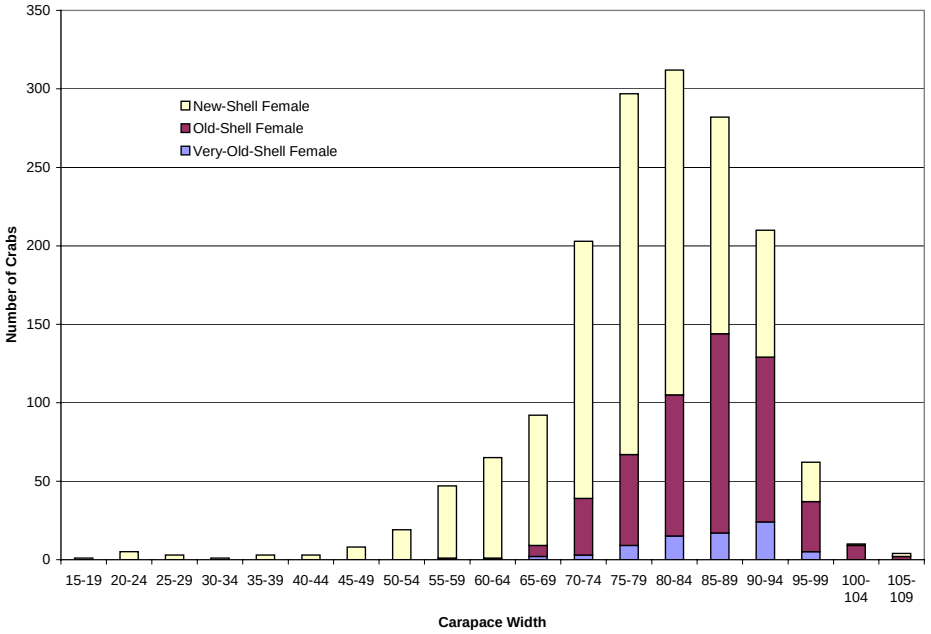

Figure 12. Female Tanner crab width frequency, by 5-mm size classes, showing shell-age categories.

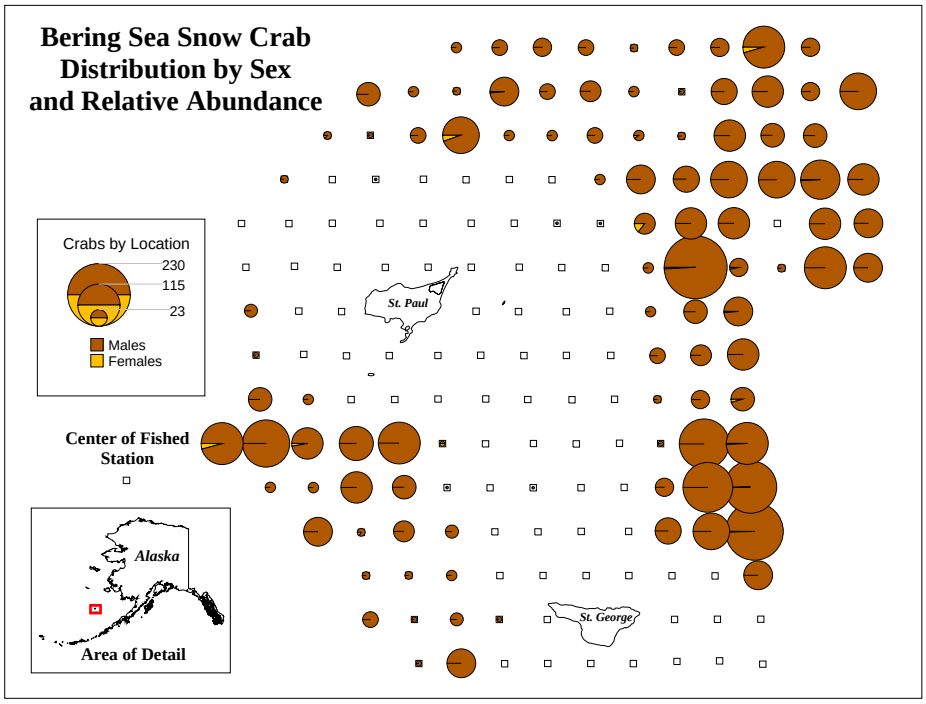

Figure 13. Distribution and relative abundance by sex of snow crab captured in the Pribilof District during the 2003 survey.

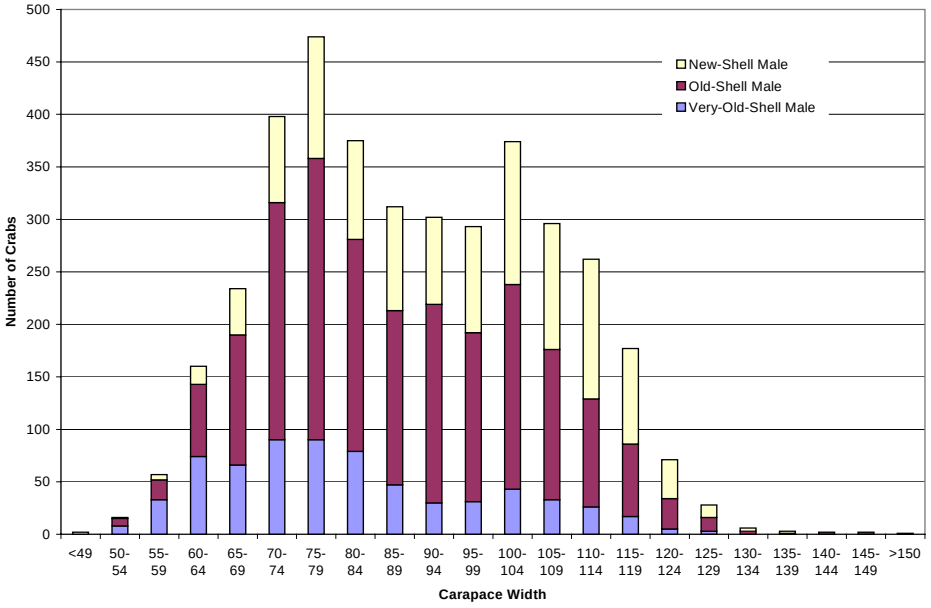

Figure 14. Male snow crab width frequency, by 5-mm size classes, showing shell-age categories.

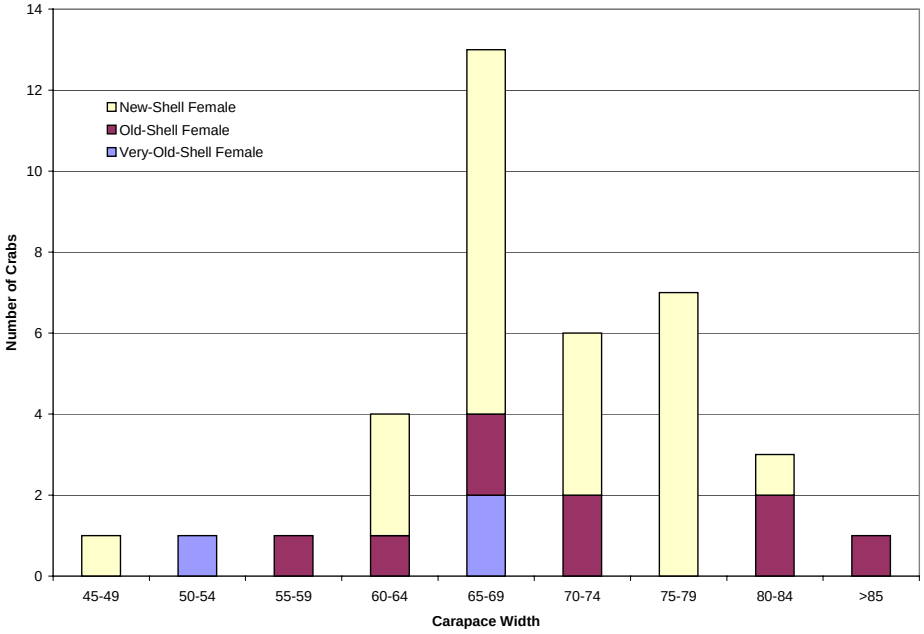

Figure 15. Female snow crab width frequency, by 5-mm size classes, showing shell-age categories.

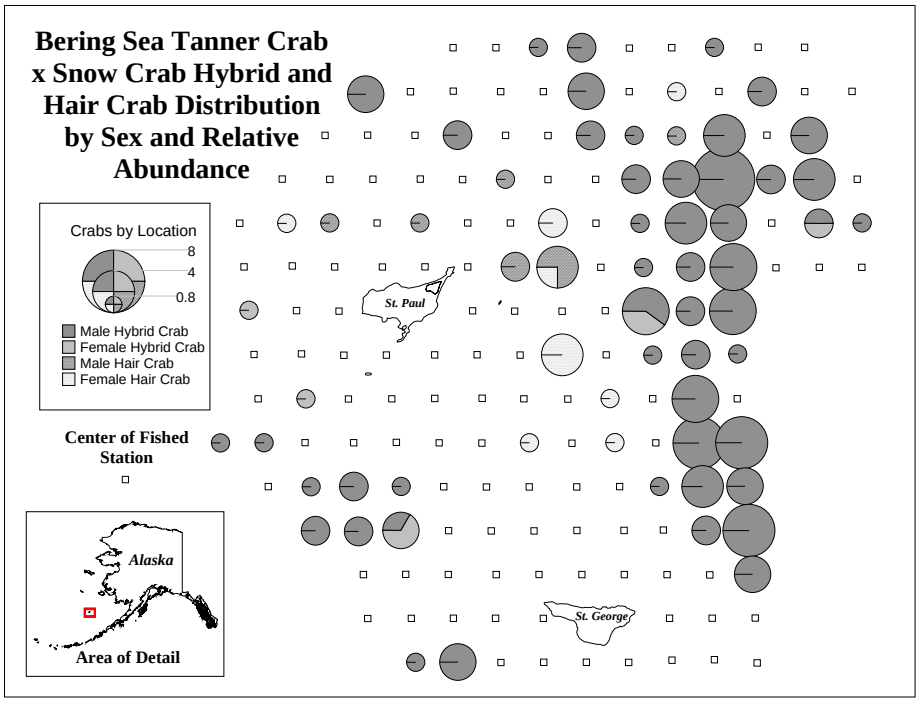

Figure 16. Distribution and relative abundance by sex of Tanner crab x snow crab hybrid and hair crab captured in the Pribilof District during the 2003 survey.

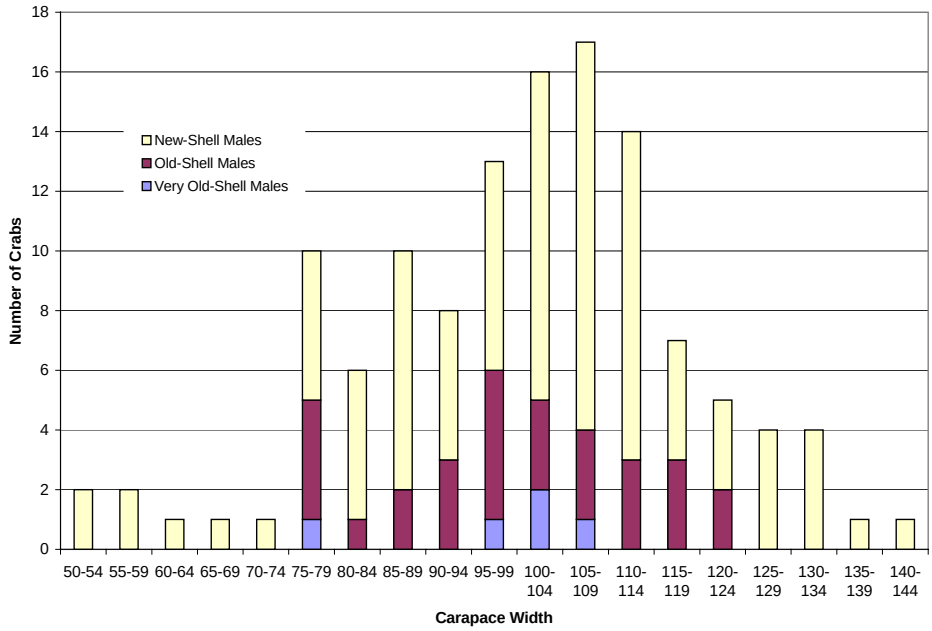

Figure 17. Male Tanner crab x snow crab hybrid width frequency, by 5-mm size classes, showing shell-age categories.

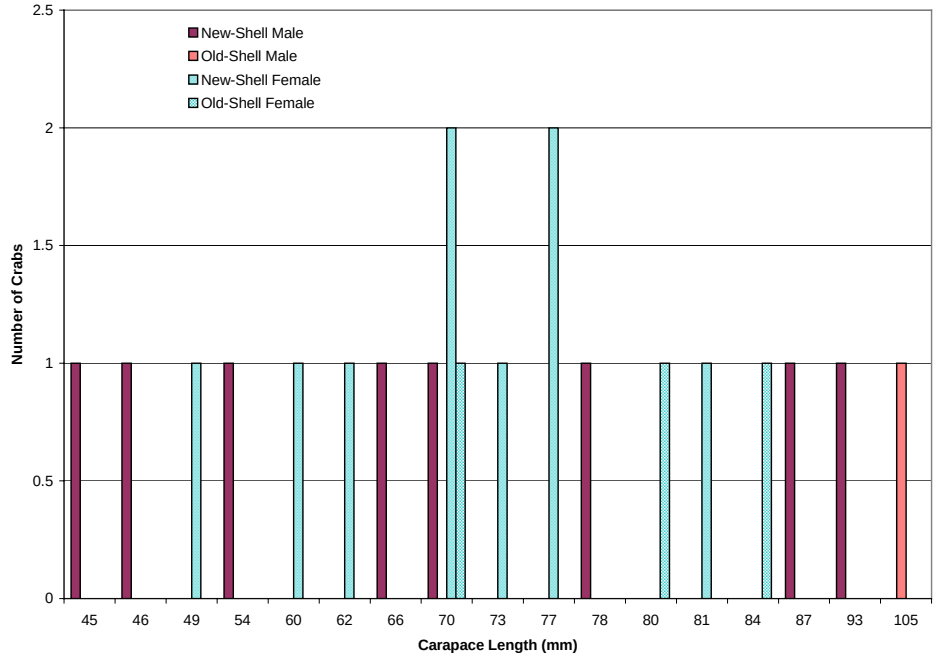

Figure 18. Male and female hair crab length frequency showing shell-age categories.

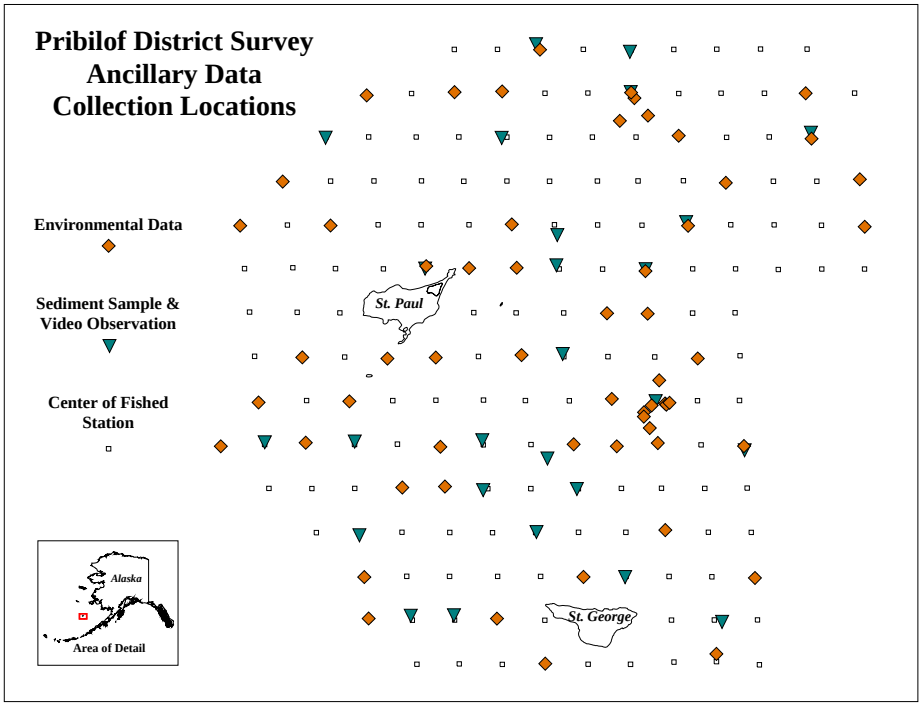

Figure 19. Ancillary data collection sites sampled during the 2003 Pribilof District survey depicting the different sites for environmental data, sediment samples, and video observations.

APPENDIX

Appendix A. Catch by station (4 pots per station) of red king crabs, blue king crabs, Tanner crabs, and snow crabs during the 2003 Pribilof District king crab survey.

Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
1	9/3	55	56	29.93	169	02.02	0	0	0	0	0	0	7	0	4	0	0	0
2	9/3	52	56	30.29	169	11.04	0	0	0	0	0	0	3	0	4	0	0	0
3	9/3	49	56	30.23	169	19.95	0	0	0	0	0	0	0	0	0	0	0	0
4	9/11	43	56	29.98	169	29.06	0	0	0	0	0	0	0	0	0	0	0	0
5	9/11	45	56	29.99	169	37.97	0	0	0	0	0	0	0	0	0	0	0	0
6	9/11	46	56	29.99	169	46.97	0	0	0	0	0	0	1	0	0	0	0	0
7	9/11	51	56	29.97	169	55.98	0	0	0	0	0	0	3	0	4	0	0	0
8	9/12	57	56	30.02	170	05.02	0	0	0	0	0	0	84	0	69	31	25	0
9	9/12	60	56	29.99	170	13.91	0	0	0	0	0	0	31	0	28	4	0	0
15	9/3	42	56	35.03	169	02.43	0	0	0	0	0	0	0	0	0	0	0	0
16	9/3	38	56	35.02	169	11.48	0	0	0	0	0	0	0	0	0	0	0	0
17	9/3	27	56	35.01	169	20.47	0	0	0	0	0	0	0	0	0	0	0	0
18	9/11	36	56	34.99	169	47.06	0	0	0	0	0	0	0	0	0	0	0	0
19	9/11	52	56	35.00	169	57.11	0	0	0	0	0	0	1	0	0	3	0	0
20	9/12	55	56	35.01	170	06.00	0	0	0	0	0	0	39	1	12	8	6	0
21	9/12	58	56	35.00	170	14.86	0	0	0	0	0	0	36	0	16	2	0	0
22	9/12	60	56	34.98	170	24.02	0	0	0	0	0	0	14	2	17	15	5	0
26	9/3	50	56	40.02	169	02.98	0	2	0	0	1	4	55	3	0	28	31	0
27	9/3	38	56	39.94	169	11.99	0	0	0	0	0	0	0	0	0	0	0	0
28	9/3	36	56	39.97	169	20.99	1	0	0	0	0	0	1	0	0	0	0	0
29	9/11	42	56	39.98	169	30.01	0	0	0	0	0	0	7	0	3	0	0	0
30	9/11	40	56	39.98	169	38.94	0	0	0	0	0	0	0	0	0	0	0	0
31	9/11	42	56	39.99	169	47.95	0	0	0	0	0	0	0	0	0	0	0	0

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Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
32	9/12	48	56	39.98	169	56.97	0	0	0	0	0	0	1	0	0	0	0	0
33	9/12	52	56	39.99	170	07.05	0	0	0	0	0	0	8	0	5	3	9	0
34	9/12	57	56	40.00	170	16.03	0	0	0	0	0	0	34	0	6	5	2	0
35	9/12	59	56	39.98	170	24.95	0	0	0	0	0	0	46	0	21	2	3	0
39	9/4	48	56	44.99	169	03.74	0	0	0	0	1	1	9	0	0	80[b]	110[b]	1
40	9/4	45	56	45.01	169	12.74	0	0	0	1	0	14	6	0	0	65	28	0
41	9/4	42	56	45.05	169	21.78	0	0	0	0	0	3	6	1	10	33	16	0
42	9/10	41	56	45.00	169	30.05	0	0	0	0	0	0	5	0	28	0	0	0
43	9/10	40	56	45.00	169	39.99	0	0	0	0	0	0	16	0	11	0	0	0
44	9/10	41	56	44.96	169	49.01	0	0	0	0	0	0	3	0	2	0	0	0
45	9/13	41	56	44.96	169	58.03	0	0	0	0	0	0	1	0	0	0	0	0
46	9/13	49	56	44.98	170	07.00	0	0	0	0	0	0	150[b]	29[b]	273	12	1	0
47	9/13	54	56	45.01	170	17.05	0	0	0	0	0	0	48	0	13	31	5	0
48	9/14	56	56	44.89	170	25.94	0	0	0	0	0	0	41	0	30	3	2	1
49	9/14	58	56	44.97	170	35.00	0	0	0	0	0	0	76[b]	5[b]	246	30	31	0
52	9/4	44	56	50.03	169	04.58	0	0	0	0	0	0	24	0	16	72[b]	95[b]	1
53	9/4	43	56	50.00	169	13.49	0	2	0	0	0	0	3	0	0	68[b]	90[b]	0
54	9/4	41	56	50.02	169	22.56	0	0	0	0	0	2	9	0	36	14	12	0
55	9/10	38	56	50.01	169	30.99	0	0	0	0	1	1	11	0	17	0	0	0
56	9/10	37	56	49.97	169	40.00	0	0	0	0	0	0	0	0	0	0	0	0
57	9/10	38	56	49.97	169	50.00	0	23	1	0	0	0	4	0	3	1	0	0
58	9/13	39	56	49.96	169	59.03	0	0	0	0	0	0	2	0	5	0	0	0
59	9/13	45	56	49.98	170	08.03	0	0	0	0	0	0	10	0	8	1	0	0
60	9/13	51	56	50.03	170	16.97	0	0	0	0	0	0	20	1	6	27	16	0

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Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
			Degrees	Minutes	Degrees	Minutes	Males		Females	Males		Females	Males		Females	Males		Females
							Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
61	9/14	54	56	50.01	170	26.96	0	0	0	0	0	0	114[b]	6[b]	5	46[b]	23[b]	0
62	9/14	56	56	49.98	170	35.94	0	0	0	0	0	0	26	1	12	7	5	0
63	9/14	57	56	50.01	170	44.97	0	0	0	0	0	0	74[b]	1[b]	233	7	3	0
65	9/4	43	56	54.99	169	05.26	0	5	0	0	0	0	9	0	2	48[b]	59[b]	1
66	9/4	41	56	54.96	169	14.26	0	2	2	0	0	0	13	0	4	115[b]	41[b]	0
67	9/4	39	56	54.98	169	23.36	0	0	0	0	2	0	4	0	4	2	2	0
68	9/10	36	56	55.02	169	31.97	0	0	0	0	0	0	35	1	48	0	0	0
69	9/10	35	56	54.94	169	41.01	0	0	0	0	0	0	42	0	35	0	0	0
70	9/10	36	56	54.99	169	49.96	0	0	0	0	0	0	167	0	33	0	0	0
71	9/13	38	56	54.95	169	59.98	0	0	0	0	0	0	32	0	30	0	0	0
72	9/13	42	56	54.98	170	08.98	0	0	0	0	0	0	20	0	40	1	0	1
73	9/13	47	56	55.04	170	18.00	0	0	0	0	0	0	0	0	1	91[b]	24[b]	0
74	9/14	50	56	55.00	170	27.00	0	0	0	0	0	0	17	0	4	65	17	0
75	9/14	53	56	55.01	170	37.23	0	0	0	0	0	0	50	0	13	49	13	2
76	9/14	55	56	54.99	170	45.86	0	0	0	0	0	0	25	0	10	84[b]	58[b]	0
77	9/14	57	56	54.98	170	55.04	0	0	0	0	0	0	30	1	116	61[b]	48[b]	5
78	9/5	42	57	00.01	169	06.21	0	0	0	0	0	0	9	0	3	26	15	2
79	9/5	40	56	59.98	169	15.02	0	15	0	0	0	1	17	0	0	16	8	0
80	9/5	38	57	00.00	169	24.03	13	157	7	0	0	0	18	1	13	4	2	0
81	9/9	33	57	00.01	169	33.00	0	6	2	0	0	0	9	0	6	0	0	0
82	9/9	33	56	59.97	169	41.91	0	0	1	0	0	0	115	0	103	0	0	0
83	9/9	34	56	59.99	169	51.14	0	0	0	0	0	0	29	0	10	0	0	0
84	9/16	35	57	00.06	169	59.94	0	0	0	0	0	0	52	0	20	0	0	0
85	9/16	36	57	00.04	170	09.92	0	0	0	0	0	0	1	0	0	0	0	0

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Appendix A. (page 4 of 8)

Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
86	9/16	34	56	59.99	170	18.97	0	0	0	0	0	0	1	0	1	0	0	0
87	9/16	42	56	59.98	170	28.09	0	0	0	0	0	0	2	0	4	0	0	0
88	9/16	46	56	59.99	170	37.05	0	0	0	0	0	0	56[b]	6[b]	35	5	3	0
89	9/16	51	56	59.99	170	47.12	0	0	0	0	0	0	11	0	12	28	14	0
91	9/5	40	57	05.10	169	06.09	0	1	0	0	0	0	9	0	4	49	15	0
92	9/5	39	57	05.02	169	14.94	0	4	0	0	0	2	3	0	3	25	6	0
93	9/5	38	57	04.96	169	24.00	0	1	1	0	0	2	2	0	0	15	5	0
94	9/9	32	57	05.00	169	33.80	0	2	17	0	1	0	56	0	20	0	0	0
95	9/9	30	57	05.00	169	43.07	0	0	1	0	0	0	85	0	18	0	0	0
96	9/9	32	57	04.98	169	51.95	0	0	0	0	0	0	8	0	0	0	0	0
97	9/16	32	57	05.02	170	01.00	0	0	0	0	0	0	22	0	4	0	0	0
98	9/15	21	57	04.99	170	09.93	0	0	0	0	0	0	0	0	0	0	0	0
99	9/15	19	57	04.98	170	20.10	0	0	0	0	0	0	0	0	0	0	0	0
100	9/15	29	57	04.95	170	29.06	0	0	0	0	0	0	0	0	0	0	0	0
101	9/17	41	57	05.11	170	37.98	0	0	0	0	0	0	0	0	1	0	0	0
102	9/16	47	57	05.04	170	47.97	0	0	0	0	0	0	80[b]	0[b]	62	4	0	0
104	9/5	40	57	09.99	169	07.13	0	0	0	0	1	1	8	0	2	37	24	1
105	9/5	39	57	09.96	169	16.05	0	1	0	0	1	17	14	0	1	33	8	0
106	9/5	37	57	09.97	169	25.47	0	1	3	1	0	1	37[b]	0[b]	17	9	2	0
107	9/9	30	57	10.03	169	34.01	0	0	18	0	0	0	15	0	7	0	0	0
108	9/9	23	57	09.97	169	43.10	0	0	0	0	0	0	52	0	9	0	0	0
109	9/9	25	57	09.98	169	53.09	0	0	0	0	0	0	0	0	0	0	0	0
110	9/16	22	57	10.01	170	01.96	0	0	0	0	0	0	0	0	0	0	0	0
111	9/17	31	57	09.98	170	30.07	0	0	0	0	0	0	0	0	0	0	0	0

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Appendix A. (page 5 of 8)

Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
112	9/17	34	57	10.04	170	39.03	0	0	0	0	0	0	0	0	0	0	0	0
113	9/17	45	57	10.08	170	49.02	0	0	11	0	0	0	0	0	2	13	2	0
115	9/7	39	57	14.99	169	07.02	0	0	0	0	0	1	17	0	11	18	9	1
116	9/7	39	57	15.00	169	16.03	0	19	0	0	1	0	1	0	0	152[b]	70[b]	2
117	9/7	37	57	14.94	169	25.94	0	15	3	0	1	1	29	0	3	8	3	0
118	9/8	32	57	14.96	169	34.93	0	0	3	0	0	0	14	0	6	0	0	0
119	9/8	24	57	14.98	169	44.05	0	0	0	0	0	0	1	0	0	0	0	0
120	9/8	22	57	15.03	169	52.92	0	0	0	0	0	0	0	0	0	0	0	0
121	9/18	16	57	15.01	170	02.95	0	0	0	0	0	0	0	0	0	0	0	0
122	9/18	13	57	15.03	170	11.98	0	0	0	0	0	0	0	0	0	0	0	0
123	9/18	12	57	15.00	170	20.94	0	0	0	0	0	0	0	0	0	0	0	0
124	9/17	35	57	15.02	170	30.99	0	0	0	0	0	0	0	0	0	0	0	0
125	9/17	40	57	15.12	170	39.93	0	0	0	0	0	0	0	0	0	0	0	0
126	9/17	44	57	15.02	170	50.08	0	0	0	0	0	0	0	0	1	0	0	0
128	9/7	39	57	20.01	169	08.03	0	0	0	0	0	5	6	0	1	40	30	0
129	9/7	39	57	20.00	169	17.01	0	2	0	0	0	0	10	0	1	46	18	0
130	9/7	37	57	19.97	169	26.67	0	2	0	0	0	2	9	0	0	24	5	5
131	9/8	33	57	19.99	169	35.97	0	1	2	0	0	0	37	0	26	1	0	0
132	9/8	32	57	20.01	169	45.03	0	0	50	0	0	0	2	0	1	1	0	0
133	9/8	32	57	20.01	169	53.99	0	0	0	0	0	0	0	0	0	0	0	0
134	9/18	27	57	20.01	170	02.98	0	0	0	0	0	0	1	0	2	0	0	0
135	9/18	29	57	20.01	170	13.03	0	0	0	0	0	0	0	0	0	0	0	0
136	9/18	35	57	20.01	170	22.06	0	0	0	0	0	0	0	0	0	0	0	0
137	9/18	35	57	20.01	170	32.01	0	0	0	0	0	0	3	0	6	0	0	0

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Appendix A. (page 6 of 8)

Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
138	9/17	41	57	19.98	170	41.08	0	0	0	0	0	0	3	0	10	0	0	0
139	9/17	44	57	19.99	170	51.00	0	0	0	0	0	0	1	0	21	0	0	0
140	9/7	37	57	24.98	169	09.10	0	3	0	0	0	2	10	0	0	72	19	0
141	9/7	38	57	25.02	169	17.99	0	29	0	0	0	0	1	0	0	48	6	0
142	9/7	39	57	25.00	169	27.50	0	6	0	0	1	0	13	0	1	49	11	0
143	9/8	37	57	24.99	169	36.03	0	0	0	0	1	1	47	0	8	6	2	0
144	9/8	34	57	24.96	169	46.07	0	0	1	0	0	0	22	1	12	0	0	0
145	9/8	33	57	24.99	169	55.00	0	0	3	0	0	0	1	0	0	0	0	0
146	9/18	32	57	24.96	170	04.05	0	0	16	0	0	0	0	0	0	0	0	0
147	9/18	34	57	25.01	170	12.96	0	0	0	0	0	0	0	0	2	0	0	0
148	9/19	36	57	25.00	170	22.93	0	0	0	0	0	0	22	0	19	1	0	0
149	9/19	38	57	24.98	170	32.01	0	0	0	0	0	0	3	0	4	0	0	0
150	9/19	41	57	25.01	170	42.05	0	0	0	0	0	0	13	0	14	3	4	0
152	9/24	38	57	30.01	168	59.96	0	2	1	1	5	11	14	0	3	30	10	0
153	9/21	38	57	29.97	169	08.91	0	2	0	0	1	1	13	0	10	56	10	0
154	9/21	37	57	29.92	169	18.97	0	1	0	2	0	6	9	0	9	4	2	0
155	9/21	38	57	29.99	169	27.91	0	6	0	0	3	0	7	0	1	7	2	1
156	9/20	38	57	29.99	169	37.08	1	3	1	3	3	4	3	0	2	15	4	0
157	9/20	37	57	29.97	169	46.06	1	0	0	0	1	0	4	0	4	7	2	0
158	9/20	37	57	29.99	169	55.00	0	1	0	0	2	0	32	0	12	8	1	0
159	9/19	37	57	30.01	170	05.10	0	1	0	0	0	0	25	0	4	68	17	5
160	9/19	37	57	30.00	170	14.07	0	2	0	0	0	0	5	0	4	15	6	0
161	9/19	37	57	30.01	170	24.04	0	0	0	0	0	0	8	0	6	3	1	0
162	9/19	39	57	29.99	170	33.03	0	0	0	0	0	0	6	0	1	5	1	1

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Appendix A. (page 7 of 8)

Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
182	9/26	41	57	14.97	168	39.97	0	0	0	0	0	0	18	0	8	45	16	0
183	9/26	40	57	14.97	168	48.93	0	1	0	1	0	2	4	1	16	98	18	0
184	9/26	40	57	14.92	168	58.06	0	0	1	0	1	0	25	0	17	6	1	0
187	9/26	40	57	20.01	168	39.90	0	0	0	0	1	0	4	0	1	42	14	0
188	9/26	40	57	19.96	168	48.99	0	0	0	0	3	0	17	0	8	45	26	0
189	9/26	38	57	20.00	168	58.95	0	0	0	1	5	29	2	0	1	0	0	0
192	9/26	39	57	25.00	168	40.95	0	2	0	0	0	1	3	0	1	55	18	0
193	9/26	39	57	24.96	168	49.97	0	1	0	1	0	5	8	0	6	78	21	1
194	9/26	38	57	24.96	168	59.09	0	1	0	0	1	4	23	0	8	62	26	0
198	9/24	38	57	29.97	168	51.06	0	0	0	0	1	0	8	1	1	29	14	0
201	9/24	38	57	35.00	168	42.04	0	0	0	0	0	0	7	0	1	75	11	0
202	9/24	37	57	34.98	168	52.00	0	2	1	0	0	2	10	0	1	24	5	0
203	9/24	36	57	34.98	169	00.97	0	1	0	0	1	1	10	0	0	64	9	0
204	9/24	37	57	34.99	169	10.08	0	7	0	2	1	5	2	0	0	45	3	0
205	9/21	37	57	34.96	169	18.95	0	4	0	1	2	0	8	0	5	2	2	0
206	9/21	38	57	34.97	169	28.96	0	28	0	1	1	0	1	0	1	10	1	0
207	9/21	38	57	35.01	169	38.02	0	1	0	0	0	0	3	0	1	27	5	0
208	9/20	38	57	34.98	169	47.03	0	5	0	0	3	0	1	0	3	20	1	0
209	9/20	38	57	34.98	169	56.04	0	2	0	1	2	0	8	0	1	47	7	1
210	9/20	38	57	35.03	170	06.01	0	0	0	0	0	0	3	0	4	5	2	0
211	9/19	38	57	34.96	170	15.03	0	0	0	0	0	0	22	0	4	5	3	0
215	9/24	38	57	40.01	168	52.01	0	0	0	0	0	0	14	0	3	24	2	0
216	9/24	37	57	40.02	169	01.78	0	2	0	0	1	0	6	0	1	99	8	5
217	9/24	37	57	40.00	169	10.98	0	1	0	0	0	1	6	0	1	27	0	0

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Station	Date	Depth (fm)	Latitude		Longitude		Red King Crab			Blue King Crab			Tanner Crab			Snow Crab		
							Males		Females	Males		Females	Males		Females	Males		Females
			Degrees	Minutes	Degrees	Minutes	Sublegal	Legal		Sublegal	Legal		Sublegal	Legal		Small[a]	Large[a]	
218	9/21	37	57	39.97	169	20.00	0	0	0	0	0	0	2	0	1	16	7	0
219	9/21	37	57	39.93	169	28.93	0	3	0	0	1	0	2	0	2	4	1	0
220	9/21	38	57	39.98	169	38.97	0	1	0	0	1	0	3	0	3	19	1	0
221	9/20	37	57	40.01	169	48.08	0	0	0	0	0	0	1	0	0	22	5	0
222	9/20	38	57	39.98	169	57.01	0	7	0	0	1	0	3	0	3	18	4	0
223	9/20	38	57	39.97	170	06.05	0	0	0	0	0	0	2	0	0	9	2	0
225	9/19	39	57	34.68	170	24.44	0	0	0	0	0	0	8	0	1	35	8	0
							16	386	146	16	53	133	2,810	62	2,148	3,122	1,358	37

[a] Small snow crab defined as ≤ 101-mm CW, large snow crab defined as > 101-mm CW (industry preferred size).
[b] Ratio of sublegal/small to legal/large determined from subsamples.